

## CLAIMS

What is claimed is:

- 1    1.    A method for fabricating a taper, comprising:  
2           disposing a semiconductor waveguide on a substrate;  
3           forming a protective layer on the semiconductor waveguide;  
4           removing a portion of the protective layer to expose a portion of the  
5 semiconductor waveguide, the exposed portion of the semiconductor waveguide  
6 defining a footprint of the taper; and  
7           forming a semiconductor layer on the exposed portion of the semiconductor  
8 waveguide to form the taper, the taper having a termination end and a longitudinal  
9 axis, wherein the termination end has at least one unetched surface that is angled  
10 relative to the longitudinal axis.
- 1    2.    The method of claim 1 wherein the semiconductor waveguide is formed using  
2 a silicon on insulator (SOI) wafer.
- 1    3.    The method of claim 1 wherein the protective layer comprises an oxide.
- 1    4.    The method of claim 1 wherein the semiconductor layer is formed using a  
2 selective silicon epitaxy process.
- 1    5.    The method of claim 4 wherein the semiconductor layer is formed into the  
2 taper without etching the semiconductor layer.

- 1 6. The method of claim 4 wherein the semiconductor layer has a sloped upper  
2 surface.
- 1 7. The method of claim 6 wherein the sloped upper surface is formed without  
2 etching the semiconductor layer.
- 1 8. The method of claim 1 wherein forming the semiconductor layer comprises  
2 depositing semiconductor material on the protective layer and the exposed portion of  
3 the semiconductor waveguide, followed by chemical mechanical polishing to expose  
4 the protective layer.
- 1 9. The method of claim 1 wherein a insulator layer is disposed beneath the  
2 semiconductor waveguide.
- 1 10. An apparatus for propagating an optical signal, the apparatus comprising:  
2 a semiconductor waveguide;  
3 a first insulating layer disposed on at least a first surface of the semiconductor  
4 waveguide;  
5 a second insulating layer disposed on at least a second surface of the  
6 semiconductor waveguide; and  
7 a semiconductor taper disposed on a portion of the second surface of the  
8 semiconductor waveguide, the semiconductor taper having a termination end and a  
9 longitudinal axis, wherein the termination end has at least one unetched surface that  
10 is angled relative to the longitudinal axis.

1 11. The apparatus of claim 10 wherein the semiconductor taper is formed from  
2 silicon epitaxially grown on a portion of the semiconductor waveguide left uncovered  
3 by the second insulating layer.

1 12. The apparatus of claim 11 wherein the semiconductor taper has a sloped  
2 surface that is parallel to the second surface of the semiconductor waveguide.

1 13. The apparatus of claim 12 wherein sloped surface of the semiconductor taper  
2 is an unetched surface.

1 14. The apparatus of claim 10 wherein the taper includes a second end to be  
2 coupled to an optical fiber.

1 15. The apparatus of claim 10 wherein the taper is formed from semiconductor  
2 material on the second insulating layer and the portion of the second surface of the  
3 semiconductor waveguide that has been planarized by chemical mechanical  
4 polishing to expose the second insulating layer.

1 16. An integrated circuit comprising:  
2 a semiconductor waveguide;  
3 a first insulating layer disposed on at least a first surface of the semiconductor  
4 waveguide;  
5 a second insulating layer disposed on at least a second surface of the  
6 semiconductor waveguide;  
7 a semiconductor taper disposed on a portion of the second surface of the  
8 semiconductor waveguide, the semiconductor taper having a longitudinal axis, a

9 termination end and a wide end, the termination end having an unetched surface  
10 that is angled relative to the longitudinal axis, and the wide end to be coupled to an  
11 optical fiber; and  
12 a protective layer formed to cover at least a portion of the semiconductor  
13 layer.

1 17. The circuit of claim 16 wherein the semiconductor waveguide is formed from  
2 silicon and the semiconductor taper is formed from silicon epitaxially grown on a  
3 portion of the semiconductor waveguide left uncovered by the second insulating  
4 layer.

1 18. The circuit of claim 17 wherein the semiconductor taper has a sloped surface  
2 that is parallel to the second surface of the semiconductor waveguide.

1 19. The circuit of claim 18 wherein sloped surface of the semiconductor taper is  
2 an unetched surface.

1 20. The circuit of claim 16 wherein the taper is formed from semiconductor  
2 material on the second insulating layer and the portion of the second surface of the  
3 semiconductor waveguide that has been planarized by chemical mechanical  
4 polishing to expose the second insulating layer.

1 21. A system comprising:  
2 an optical signal source;  
3 an optical fiber, coupled to the optical signal source, to propagate an optical  
4 signal; and

5 an integrated circuit that includes:  
6 a semiconductor waveguide;  
7 a first cladding layer disposed on at least a first surface of the  
8 semiconductor waveguide;  
9 a second cladding layer disposed on at least a second surface of the  
10 semiconductor waveguide; and  
11 a semiconductor taper disposed on a portion of the second surface of  
12 the semiconductor waveguide, the semiconductor taper having a longitudinal axis, a  
13 termination end and a wide end, the termination end having an unetched surface  
14 that is angled relative to the longitudinal axis, and the wide end coupled to the  
15 optical fiber.

1 22. The system of claim 21 wherein the semiconductor waveguide is formed from  
2 silicon and the semiconductor taper is formed from silicon epitaxially grown on a  
3 portion of the semiconductor waveguide left uncovered by the second cladding layer.

1 23. The system of claim 22 wherein the semiconductor taper has a sloped  
2 surface that is parallel to the second surface of the semiconductor waveguide.

1 24. The system of claim 23 wherein sloped surface of the semiconductor taper is  
2 an unetched surface.